Solutions for Dealing with Changes in Logistics Operations Environment

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Recently, the logistics environment has been changing dramatically. Shifting consumer behavior as represented by the expansion of business-to-customer (BtoC) and customer-to-customer (CtoC) transactions via the Internet has brought about rapid increases and fluctuations in parcel quantities as well as an increase in frequent and small-lot deliveries, including same-day deliveries. Meanwhile, logistics companies face the problem of serious labor shortages caused by the aging of truck drivers, the decreasing number of driver's license holders, and soaring labor costs due to Japan's economic recovery. Fujitsu has long assisted logistics companies with the transformation and improvement of their business operations through solutions making use of ICT. We now provide the FUJITSU Logistics Solution Logifit Series, which covers logistics as a whole. The Logifit Series supports the transformation and improvement of business operations including dealing with environmental changes ranging from solutions for individual logistics-related issues having to do for example with distribution centers, transportation, and delivery, to the optimization of overall logistics operations. This paper presents an overall picture of the Logifit Series, introduces solution-based activities for dealing with business environment changes, and discusses future directions.

1. Introduction

The year 2017 saw long work hours and delivery delays in the logistics industry being taken up as issues affecting society, along with growing awareness of these issues among ordinary consumers. At the root of these issues is the shortage of truck drivers and a paradigm shift in consumer behavior. The latter in particular is caused by the expanding strength of convenience stores appealing to consumers with a growing array of everyday products and services, and the rapid increase in the number of home deliveries arising from the growth of business-to-customer (BtoC) and customer-to-customer (CtoC) markets via the Internet. As a result, the quantity of parcels handled by the logistics centers at the end of the supply chain, which cover the so-called "last mile" to consumer hands, has increased substantially.

Conventional logistics are often regarded as a cost center, and demand for cutting costs has been high. However, these environmental changes are also having an impact on the clients such as the manufacturers and retailers, as well as the contractors such as the logistics companies and third party logistics (3PL) companies. For example, for an increasing number of companies, transportation and delivery execution, including how to reliably pick up and deliver parcels at the fixed date and time is a management challenge besides cost cutting.

Through solutions making use of ICT, Fujitsu has long been assisting logistics companies with the transformation and improvement of their business operations. We now provide the FUJITSU Logistics Solution Logifit Series, which covers logistics as a whole. The Logifit Series supports the transformation and improvement of business operations including dealing with environmental changes ranging from solutions for individual logistics-related issues having to do for example with distribution centers, transportation, and delivery, to the optimization of overall logistics operations.

This paper presents an overall picture of the Logifit Series. As an example of a solution-based application, it describes a delivery route planned based on simulation factoring in actual conditions such as actual place, actual things, and actual activities that

compares and verifies the virtual world against the real world. It concludes with a discussion of the direction of future initiatives.

2. Evolution and challenges of logistics

The logistics for products frequently purchased by consumers, such as everyday items and groceries, has traditionally been the three-layer model of manufacturing, wholesaling and retailing involving retailers such as general merchandise stores, with logistics linking all three layers. On the other hand, the home delivery service industry has traditionally been a CtoC business model centered on deliveries of seasonal gifts and deliveries among relatives.

However, changes in the business environment that conventional logistics models are unable to deal with are happening at a rapid pace. These include the increasing strength of convenience store and drugstores chains, the shift to online sales in the BtoC retail sector, typified by Amazon, and the growth of CtoC retail via smartphone apps typified by eBay (**Figure 1**).

As a result, logistics companies and 3PLs (the contractors) are experiencing dramatic increases in the number of parcels they have to handle, more frequent small-lot deliveries, including same-day deliveries, and rapid fluctuations in quantities depending on sales and campaigns. Meanwhile, logistics companies face serious labor shortages due to aging of truck drivers, the decreasing number of holders of a driver's license for trucks, and soaring labor costs due to Japan's economic

recovery. These trends are the reasons why transportation and delivery execution has become a management challenge for clients and contractors.

In response to the labor shortage, the government is in the process of relaxing and revising applicable laws and regulations. Traditionally, passenger carriers such as buses and taxis, and freight carriers such as trucks specialized in the transport of people and goods, respectively. The government has changed this system to allow mixed carrier operations that combine bus/taxi transport of passengers and truck transport of freight under certain conditions when an operator has obtained licenses for both types of business.[1] In Japan, further, the enforcement of the Revised Act on Advancement of Integration and Streamlining of Distribution Business supports the collaboration of companies for modal shifts, from truck to railroad for example, the adoption of joint shipping operations, the consolidation of logistics networks, and so on.[2]

3. Initiatives making use of Fujitsu's solutions

3.1 Fujitsu's logistics solutions

Fujitsu has long been providing solutions using ICT to solve logistics challenges. Since 2012, we offer individual solutions related to logistics as the Logifit Series. The Logifit Series supports the transformation and improvement of business operations including response to environmental changes ranging from solutions for individual logistics-related issues having to do for example with distribution centers, transportation, and delivery, to the optimization of overall logistics operations.

Currently, the Logifit Series consists of three solution groups, "Logistics Information System Solutions," "Distribution Center Solutions," and "Transportation System Solutions." We combine these solutions with the services, software, and hardware required by customers to realize optimum logistics systems (**Figure 2**). Going forward, we intend to aggressively expand the services we offer while incorporating recent technologies of note, such as IoT, AI, and big data.
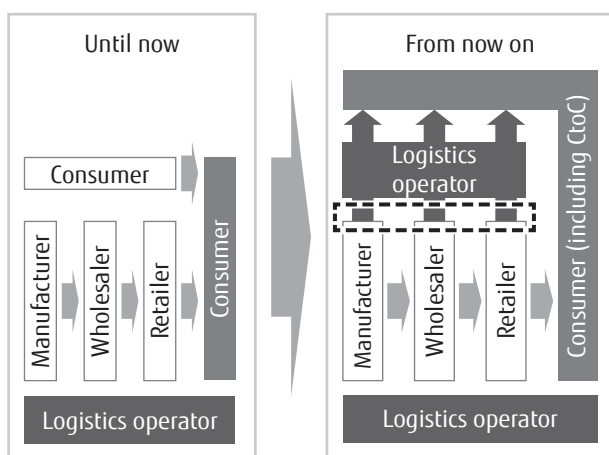

Figure 1
Evolution of logistics.

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KPI: Key performance indicator
Zinrai: The Fujitsu AI brand, a collective framework
for the broad family of AI capabilities that
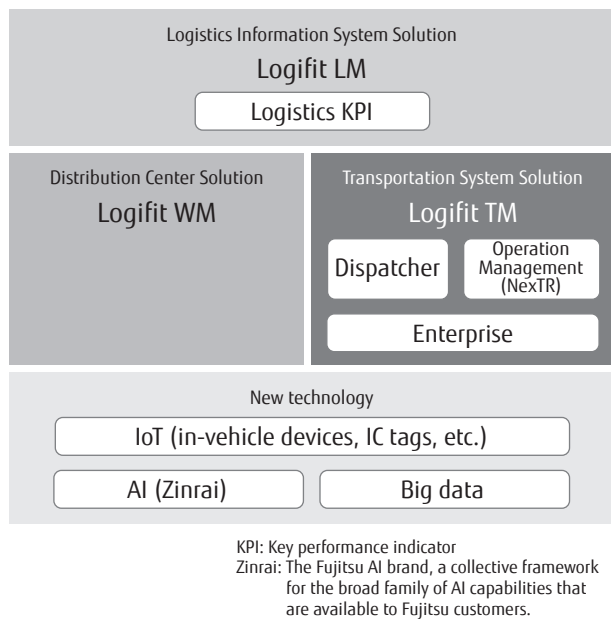are available to Fujitsu customers.

Figure 2
Configuration of Logifit Series.

3.2 Planning of delivery routes through comparison and verification of the virtual world against the real world

How to plan delivery routes is key to achieving fulfilment of the mutually antithetic requirements of cost reduction and timely transportation and delivery execution. Fujitsu has been offering Logifit TM-Dispatcher as a solution that supports planning of delivery routes, a task that until now was done mostly through virtual world simulation. However, fluctuations in work durations at delivery destinations owing to rapid increases or fluctuations in parcel quantities, as well as variable travel times between deliveries greatly affect simulation results. This has made achieving realistic simulations reflecting such factors to produce results useful in the real world a challenge.

On the other hand, as a solution to support operations management to ensure safe, secure, and reliable transportation while preventing traffic accidents by complying with the various applicable laws and regulations, Fujitsu has been offering Logifit TM-NexTR as SaaS (software as a service). This solution is designed to acquire data on operation results from in-vehicle devices or smart devices to ensure safe driving, improve delivery quality, reduce fuel costs, and so on. However, the fact that utilization of data for purposes other than operations management, such as operation efficiency and productivity analysis and delivery route planning had not advanced much was a problem.

Fujitsu recommends the use of these two solutions, Logifit TM-Dispatcher and Logifit TM-NexTR, in tandem to achieve a detailed understanding of delivery operations in the real world along with the pursuit of optimum routes in the virtual world (**Figure 3**).

Specific measures are described below.

1) Based on operation records acquired with Logifit TM-NexTR, work durations at delivery destinations and travel durations between delivery destinations are extracted and input to the Logifit TM-Dispatcher system to raise simulation accuracy.

2) Using the delivery route planned with Logifit TM-Dispatcher as the master, the accuracy of the route is checked and confirmed through management of actual versus forecast results in coordination with Logifit TM-NexTR.

By repeating the above steps as the PDCA (Plan-Do-Check-Act) cycle, the accuracy of the delivery work is further improved.

3.3 Issues related to the application of solutions

From the viewpoint of management at the manufacturers/retailers who are the clients, logistics operations are a cost center, and as such, increasingly they feel the need to control logistics themselves. However, it is rather inefficient for companies involved in the supply chain and demand chain to individually carry out logistics measures. A more rational course of action would be for companies to cooperate and collaborate with the aim of bringing down the total logistics cost, and sharing the resulting savings.

To that end, it is necessary for the client and contractor to build a win-win relationship.

3.4 Approach to problem solving

As an example, the following introduces Fujitsu's approach to optimize delivery route planning. As shown in **Figure 4**, from the perspective of the client, it is not possible to figure out the details of the logistics costs presented by the contractor, and thus there are no means to verify the validity of the delivery route.

Fujitsu supports efforts to plan delivery routes as

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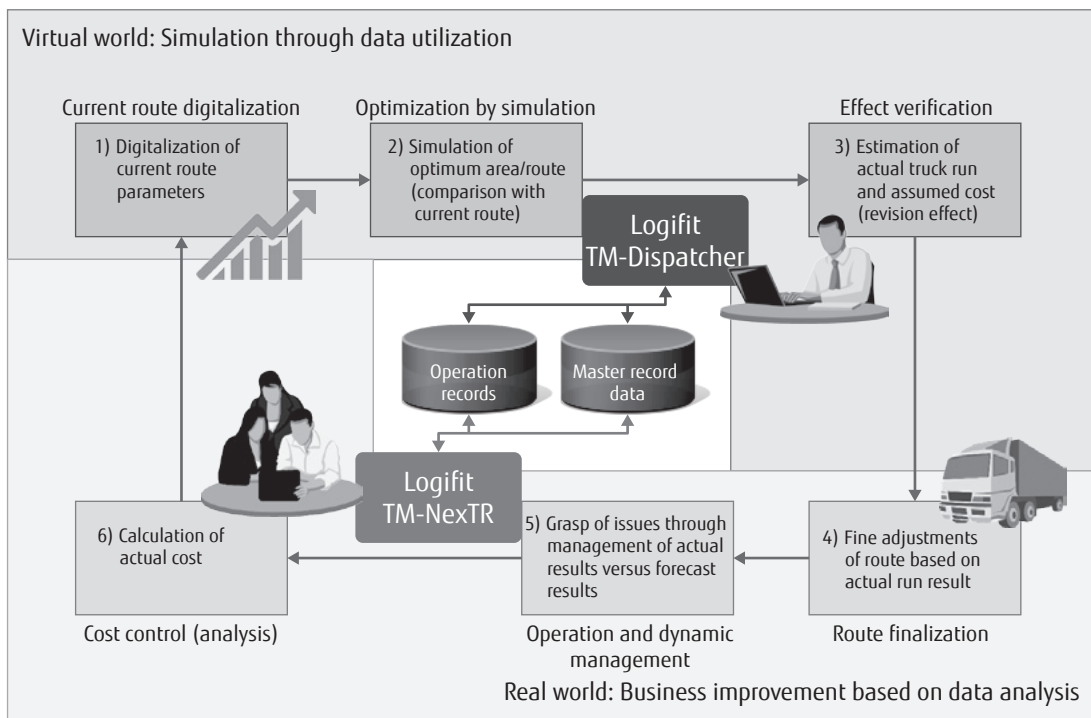Digital Transformation in Manufacturing and Distribution Industry
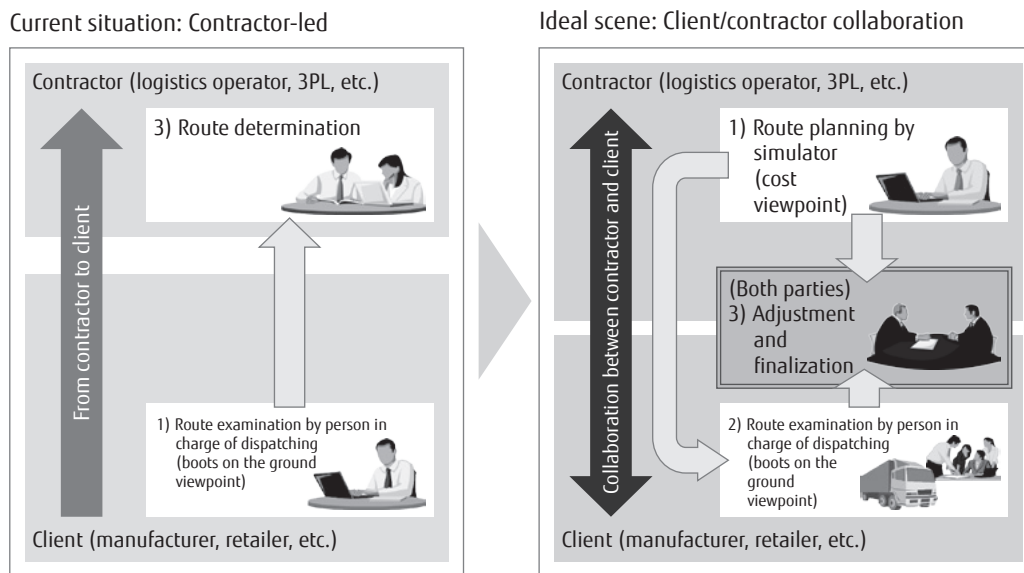
Figure 3
Improvement of delivery efficiency.

Figure 4
Approach to revision of delivery route planning process.

a collaboration between the client and the contractor through comparison and verification of the virtual world against the real world as described above. Concretely, the client plans the delivery route from the viewpoint of logistics cost, and the contractor checks the proposed delivery route from the viewpoint of the actual

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conditions on the ground. It has been demonstrated that delivery costs can be cut by 5% to 10% as a result. Aspects such as how to distribute the fruits from this process transformation require detailed consideration by the client and the contractor.

4. Direction of future initiatives

4.1 Support of planning on a predictive basis

In the case of large quantity fluctuations, delivery route planning on the basis of shipping history may result in the need to frequently resort to the dispatch of extra trucks. As a solution to this problem, we are considering quantity forecasting and delivery route planning based on area analysis, that design routes on a forecasting basis taking into consideration local conditions (**Figure 5**). Specifically, the target locality will be set as the area, and using a digital map (Layer 1: Map section) as the base, profiling of each inhabitant of the area will be done by factoring in the geographical and demographic characteristics obtained from census and private research results (Layer 2: Local characteristics section) and the shipping history, including wait and stand-by times (Layer 3: Cumulative results section).

Using these results as input data, the demand forecasting approach will be employed with the application of AI. For forecasted quantity, comparison and evaluation of delivery areas and routes will be done based on the assumed factors, including the possible times that residents will be at home and the required delivery durations by area. At present, utilization of AI is still at the machine learning stage, but in the future, deep learning will have a role for raising accuracy.

4.2 Support of various home delivery models

Currently, some logistics operators offer services that allow customers to select, as an alternative to home delivery, a nearby point such as a convenience store or delivery locker as the parcel delivery location, if they so desire. The key for such services is where to position the drop-off points where customers can
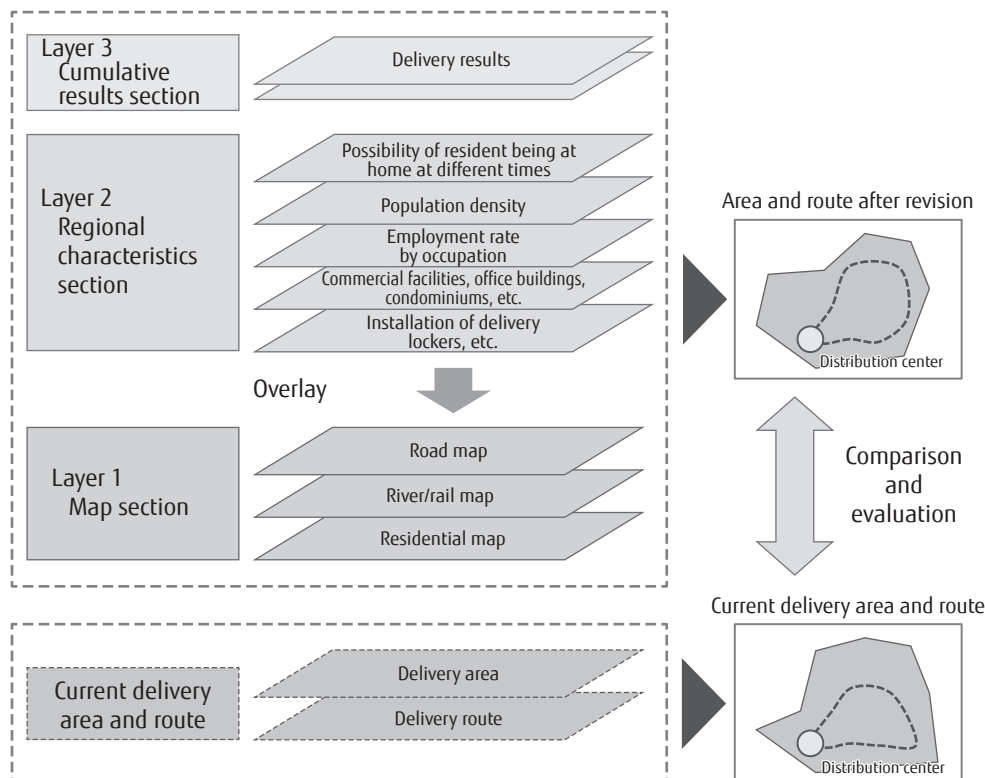

Figure 5
Quantity forecasting and route planning through area analysis.

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receive their parcels. This is an area where Fujitsu will be able to put to use the know-how and knowledge it has acquired in the process of supporting the selection of distribution center locations and target areas.

Moreover, there are new logistics operators that provide crowdsourcing services that allow customers to search for and request nearby parties who can make the delivery. Thus, as new types of logistics services are emerging, business model creation and operations design support needs are also increasing. We believe that this trend is also an area where Fujitsu's expertise in and knowledge of logistics in general and our proprietary technologies in fields such as IoT and AI will be of use.

5. Conclusion

This paper described concrete examples of the utilization of Fujitsu's Logifit Series to deal with changes in the logistics environment, and discussed the direction of future initiatives.

Consumer behavior and social systems are expected to change dramatically in the future. Besides expanding the use of technologies such as IoT, AI, and big data, and expanding the application of existing methods such as demand forecasting, Fujitsu is also promoting the improvement of customers' logistics sites through the application of the actual conditions mentioned before. Further, through co-creation with our customers, we aim to contribute to the realization of a richer society.

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